Revisiting the fertility transition in England and Wales: The role of social class and migration

Short title: Revisiting the fertility transition in England and Wales

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Abstract

We use individual level census data for England and Wales from 1851–1911 to investigate the interplay between social class and geographical context determining patterns of child bearing during the fertility transition. We also consider the effect of spatial mobility or life-time migration on individual fertility behaviour in the early phases of demographic modernisation. Prior research on the fertility transition in England and Wales has demonstrated substantial variation in fertility levels and declines by different social groups, however these findings were generally reported at a broad geographical level, disguising local variation and complicated by residential segregation along social class and occupational lines. Our findings confirm a clear pattern of widening social class differences in recent net fertility, providing strong support for the argument that belonging to a certain social group was an important determinant of early adoption of new reproductive behaviour in marriage in England and Wales. However, a relatively constant effect of lower net fertility amongst long-distance migrants both before the transition and in the early phases of declining fertility indicates that life-course migration patterns were most likely factors in explaining the differences in fertility operating through postponement of marriage and child bearing.

Keywords: fertility transition, nineteenth century, census micro-data, historical demography, migration, England and Wales

Introduction

The vast body of research on the determinants of the historical fertility transition generally locates its origins at the time, in the late nineteenth and early twentieth century, when contemporaries first started noticing profound changes in fertility in their society. A century or more later, we have a far more complete understanding of the timing of the process and overall patterns of decline but the precise causal pathways which led to reduced fertility remain somewhat speculative and subject to debate (Becker 1981; Cleland & Wilson 1987; Coale & Watkins 1986; Easterlin 1975; Galor & Weil 2000; Mason 1997). A particular research challenge has been to formulate an explanatory framework of fertility decline which can account for the full diversity of experiences from high to low fertility across an array of distinct social and economic contexts.

Broadly defined, explanations of fertility decline often distinguish between two concepts of behavioural change: 'innovation' and 'adjustment' that need to occur before new reproductive habits are adopted (Carlsson 1966). The 'innovation' perspective attributes falling fertility to the spread of new knowledge of means of contraception and attitudes, while the 'adjustment' or 'adaptation' perspective conceptualises fertility decline as a response to a transformation of the economic and social environment. The latter perspective is closely related to the associated changes in the costs of having children and to the concept of the demand and supply of children (Easterlin and Crimmins 1985). The main evidence for this argument outlines the changes in economic organization during the nineteenth century in which the introduction of restrictions on children's participation in the labour force and the enforcement of school attendance combined to increase the relative costs of having large families.

Adherents to the two forms of explanation generally agree that analysis of the extent of socioeconomic variations in fertility, and how these are transformed during the process of fertility decline, is fundamental to any understanding of the nature of fertility transition.

Previous research has highlighted that as fertility transitions take off socio-economic differentials in fertility tend to widen and that the upper and middle classes were, in most cases, the first to move towards lower fertility (Dribe et al. 2014; Dribe and Scalone 2014; Haines 1992). The general view from previous work is that both adjustment and innovation processes lie behind the observed socio-economic patterns. It is thought that higher social groups were more likely to adapt their fertility behaviour to new economic circumstances; they were also thought to be the first group to seek fewer higher 'quality' children rather than a higher 'quantity' of offspring to match parents' material aspirations (Dribe 2009). In addition, fitting with the 'innovation' perspective, the upper and middle classes were the first to experience new social attitudes towards family planning as they were in a better position to acquire new knowledge and information through education and through their social networks which stretched across wide distances (Szreter 1996; Woods 1987).

Access to information has an important role in many of the debates about the origins of historical fertility transition. Behavioural changes in society are seen as resulting from new ideas and values spreading through the population; this spread of information was, however, limited by spatial and social distance (Garrett et al. 2001, Goldstein and Klüsener 2014, Szreter 1996). The increasing spatial mobility and rapid urbanization of the population especially during the latter half of the nineteenth century made an important contribution to this process. Clearly relocation to a new social environment often went hand in hand with important life course events and, based on previous research, migration is often seen to influence an individual's fertility behaviour through four possible mechanisms: socialisation, adaptation, selection and disruption (Kulu 2005). Recently, Klüsener and colleagues (2019) have argued that life-time migration and distances migrated could be indicative of the spread of information and the expansion of knowledge networks which led to the adoption of fertility limitation. This is fundamentally based on the following assumptions: firstly, migrants living further away from their place of birth might have had better access to information simply because their social networks covered larger areas and longer distances. Secondly, recent migrants to an urban settlement may have found it easier to adopt new social attitudes to family limitation as a direct result of finding themselves free of the tighter social controls of their native villages. As city dwellers it is possible that their fertility decisions were less influenced by the pressures of family, members of the older generation and their home community to have larger families. It is also possible that migration is correlated to fertility through co-determination by an unmeasured variable: it has often been argued that migrants are likely to be selective of those with a more enterprising or ambitious nature. These characteristics may produce both longer distance migration and a willingness to adopt new ways of fertility-controlling strategies. However, the disruptive nature of migration coupled with the difficulties of integrating into a new environment, may have also left migrants disinclined to have large families, particularly when they had no local or familial support networks (Creighton et al. 2012).

Alternatively the relationship could be the result of reverse causality. Previous evidence suggests that in the British Isles most life-time migration occurred in the young adult period, before or on marriage and generally before the birth of children (Day 2015, 2018a; Reid et al. 2016; Schürer 2003; Wall 1987). It is likely that early marriage and child-bearing are a strong disincentive to migration: they make moving logistically more problematic and also more costly, so individuals who choose (or are forced) to start a family young may be less likely to migrate. For example, from the perspective of place of destination migrants to Antwerp (Belgium) and Geneva (Switzerland) were more likely to postpone marriage and childbearing to a later age than the native populations. In Antwerp this was particularly clear amongst long-distance migrants (Schumacher et al. 2013). However, these differences might be even wider when analysing fertility behaviour of leavers and stayers from the perspective of their place of origin. It is important to note that over the course of the nineteenth century the magnitude and context of geographical mobility changed dramatically. This was a period of rapid modernization and part of it was the development of transport networks at remarkable speed. The expansion of the railways in particular meant that previous ideas of 'short' and 'long' distance were being transformed: a further aspect of the changes underway in the society (Gregory and Henneberg 2010).

The context: Fertility transition in England and Wales

This paper aims to revisit the debate on fertility transition by using rich, individual-level, decennial census data for England and Wales (1851–1911) to investigate the effects of social class and spatial mobility on individual fertility behaviour. The countries' early industrialization and urbanization, their geographically-clustered industries and their complex occupational structure all provide an ideal setting in which to test the influence of class and increasing population mobility on fertility decline. Fig. 1 highlights the dramatic changes in fertility, mortality and nuptiality that England and Wales experienced between the 1840s and the 1920s.

(Fig. 1 about here)

Research on the fertility transition in the British Isles has established that a substantial fall in marital fertility took place over the second half of the nineteenth century (Coale and Watkins 1986; Morse 1987; Teitelbaum 1984; Woods 1979, 2000). Studies have also found substantial variation in fertility levels and rates of decline between social groups (Anderson 1999; Ó Gráda 2008; Woods 1984). In pre-industrial England, prior to the onset of fertility decline, there was little difference in the marital fertility of occupational groups (Wrigley *et al*. 1997 pp. 427–9). Without fully considering the changing composition of the English family reconstitution sample over time, recent explorations of fertility differences in preindustrial England found that the higher social classes were likely to have larger families than other social classes; but by the early nineteenth century social class differences in family size had diminished (Boberg-Fazlic et al. 2011; Clark and Cummins 2009; Clark and Hamilton 2006). The main sources used to study class differentials in fertility during the fertility transition have also been sample populations for specific places in the mid-nineteenth-century censuses, or aggregate data from the 1911 Census of Fertility for England and Wales (Garrett et al. 2001; Haines 1979, 1992; Innes 1938; Stevenson 1920; Woods 1984; Woods and Smith 1983).

Using data from the published 1911 Census Report on the Fertility of Marriage (1917, 1923), Szreter's (1996) comprehensive study of fertility in Britain downplayed the importance of social class as a determinant of differences in fertility, favouring instead 'communication communities'. Recent work by Barnes and Guinnane (2012) has challenged these results and argued that, on the contrary, as much as two thirds of the variation between couples in marital fertility was explained by social class. The debate that followed in the *Economic History Review* highlights the continued interest and complexity of the importance of social class and socio-economic status in determining changes in family size (Barnes and Guinnane 2017; Szreter 2015). Although the authors disagree on various points, their work has emphasised that geography and community differences within and between regions both have important roles in determining patterns of fertility, and has highlighted the need for further research using large-scale individual-level data to account for the interplay between geography and social class.

Work by Garrett *et al* (2001) on individual level data from 13 English and Welsh communities in 1891, 1901 and 1911 also suggested that 'place' and 'class' worked in tandem to produce patterns of fertility behaviour: for example, the fertility of middle class couples living in predominantly working class areas more closely resembled that of their lower class neighbours than that of the middle class in general. While this work was able to establish nuanced geographical and social patterns, it was limited to a small and disparate group of non-contiguous places and, because they were an amalgam of both spatial and social factors, the dimensions of the spatio-social groups, referred to by Szreter (1996) as 'communication communities' and dubbed 'environments' by Garrett *et al* (2001), remained unclear. It became evident that a finely grained analysis with much wider geographical coverage, identifying the occupational or social mix of relatively small spatial units, was essential to the identification of the forces determining variations and changes in fertility.

This paper contributes to this debate by demonstrating how geographical patterns at a finer scale can enhance our understanding of historical fertility decline in England and Wales. This is done in two ways; on one hand we focus on how the interplay between socioeconomic status and geographical context determined patterns of behaviour and child bearing during the fertility transition, and on the other we shed new light on the effect of spatial mobility on individual fertility behaviour.

Data and Methods

Integrated Census Microdata (I-CeM)

The main data source for this paper is individual level census data for England and Wales from 1851–1911 (except 1871 for which only very limited data are currently available for research purposes), provided via the Integrated Census Microdata (I-CeM) project (Higgs et al. 2013; Schürer and Higgs 2014).[1] Each individual's census record includes information on their sex, age, marital status, occupation, place of residence, place of birth and relationship to the head of their household. The latter variable makes it possible to link each married woman to her spouse and children if living in the same household. Our analysis is based on an enhanced version of the original I-CeM data in which household variables have been more precisely specified and individuals have been more accurately allocated to the Registration

[1] Schürer et al (2018) and Reid et al (2019) provide more information about I-CeM database and in particular about the way that individual level census data can be used to examine fertility.

Sub-District (RSD) in which they were recorded by the census.[2] The population of England and Wales more than doubled over the 60 year period from 1851 to 1911. In the I-CeM database the population in 1851 is around 17.5 million in about 3.7 million households; by 1911 the population has increased to 36 million in almost 8 million households. The I-CeM database provides near complete census coverage, however a small number of original census pages have been lost or destroyed and in a few cases full enumeration districts, parishes or even whole RSDs are affected.[3]

Measures

Recent marital net fertility

Because of the way census data were collected prior to 1911, our analysis of fertility differentials has to rely on the number of a woman's surviving children currently living in the same household with her rather, than on the number of children ever born (although this latter measure was reported for 1911 due to the special 'fertility of marriage' questions asked in that census). We only consider children under age 5 as living away from parents increases after that age. Nevertheless, a small proportion of children aged 0 to 4 (between 5% to 10% in all census years) were not living with their parents, most likely due to orphanhood, illegitimacy or because they were staying with relatives or friends during the census enumeration. Thus 'own children within the household' is a measure of recent net fertility and has found common use in studies of fertility decline using historical individual-level census data (Hacker 2003, 2016; Dribe et al. 2014; Dribe and Scalone 2014). This 'own children' measure is 'net' because it does not take account of any mortality experienced by a woman's children

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[2] The version of the I-CeM data used here has been enhanced as part of the ESRC-funded An Atlas of Victorian Fertility Decline project (ES/L015463/1) at the Cambridge Group for the History of Population and Social Structure, Department of Geography, University of Cambridge. For further details, see *http://www.geog.cam.ac.uk/research/projects/victorianfertilitydecline/*

[3] I-CeM is missing a number of RSDs in full as a result of the original archival records having been lost or destroyed –1851 (14 RSDs with the combined population of 81,278 (0.5% of the total population of England and Wales)), 1861 (5 RSDs with the combined population of 95,148 (0.5% of the total population)) and 1901 (4 RSDs with population total of 46,754 (0.1%)).

prior to the census enumeration (Reid et al. 2019). We acknowledge that differences in mortality between population sub-groups, for example by social class or place of residence, may have an impact on observed differences. For most social groups fertility and mortality were positively correlated at an aggregate level, so the differences in fertility are slightly reduced when mortality is not taken into account. For example higher social classes had both low fertility and low child mortality, whereas manual labourers and miners had large completed families and also experienced high levels of child mortality. Nevertheless there are important exceptions, namely women married to textile workers, who had low fertility but relatively high infant and child mortality, and women married to agricultural labourers, who had high fertility and low infant and child mortality (Garrett and Reid 1994; Haines 1989; Woods and Smith 1984). Comparisons involving these groups must therefore be treated with more caution.

We calculated recent marital net fertility for each married woman aged 15–54 in each census, whose spouse was present with her.[4] The husband's presence was necessary because each woman's socio-economic status was derived from her husband's occupational status, as the great majority of married women did not return an occupation of their own. In 1851, 18% of married women gave an occupation, or were returned as 'economically active', but by 1911 this had reduced to just 9%. Previous work has demonstrated that both changes in social attitudes and in the recording of female, especially married women's, occupation played important role in declining labour force participation rates for women (Goose 2007; You 2014).

Social status

The census data provide extremely detailed information on male occupation; however, for the purposes of the current analysis we used the eight *social classes* first introduced by the

[4] A table with information about the census population and our final study population is included in the Online Appendix (see Table A1).

Registrar General T. H. C. Stevenson to analyse fertility in his *Report* on the 1911 census enquiry into the *Fertility of Marriage* (1923). The new classification evolved from previous occupational schemas but in addition to the five graded classes another three so-called 'industrial classes' were given groups of their own (Szreter 1984). In broad terms the eight classes are based on both social status and occupation: Class I – upper and middle classes (professional and managerial), Class II – other non-manual workers (note that these included farmers), Class III – skilled manual workers, Class IV – semi-skilled manual workers, Class V – unskilled workers, Class VI – textile workers, Class VII – miners, and Class VIII – agricultural labourers. The last three categories were singled out by Stevenson specifically to analyse differences in fertility, because they demonstrated unusual or extreme experiences within the working classes. Agricultural labourers were firmly part of the labouring classes, but unlike other labourers they lived in healthy rural areas rather than in towns and cities, which tended to have higher mortality. Like agricultural labourers, miners had particularly high levels of fertility, but unlike agricultural labourers, they suffered high levels of child mortality. In contrast, textile workers were treated separately because their fertility was unusually low for the working classes (Szreter 1996).[5] In this analysis, we applied the social class classification to all census years which of course entails the (possibly erroneous) assumption that the occupations grouped together in 1911 were of a similar social status in 1851.

Life-time migration

The measure of migration used in the analysis is calculated as a distance between a woman's place of birth and the place in which she was enumerated. Each individual born within England and Wales was asked to give the parish and county in which they were born. Those born outside England or Wales were asked to give just their country of birth. 'Outside

[5] In addition to these eight social classes we also included a separate 'Unknown' category for certain cases where the detailed information on occupation was missing or uncertain. This last group is largely comprised of those who either had no recorded occupation, were living on their own means, were retired, or whose census entry was illegible.

England and Wales' includes those born in Scotland and Ireland despite both being part of the United Kingdom at the time. This means that distance between place of birth and place of residence could only be calculated for those born within England and Wales, and within these, only for those who gave sufficient detail in the census on their place of birth to allow this to be accurately identified. In order to produce life-time migration measures from nineteenth century census data the birthplace strings were standardised from 6.5 million plus unique strings to a smaller set of some 16,000 parish and county combinations (Schürer et al. 2015; Schürer and Day 2019). For each individual with a valid identifiable birthplace, a Euclidean distance, measured in kilometres (km), was calculated between the centroids of the place of birth and the parish of enumeration.[6] In our population of interest, the percentage of women born abroad ranged from 5–8% and less than 1% of women had insufficient information to enable their place of birth to be identified (Day 2018b).

Table 1 demonstrates the age-standardized mean net life-time migration distances for women in each of the social classes from 1851 to 1911. As might be expected, women married to upper and middle class men had migrated the longest mean distances, around 65 to 70 km, in each census year. It would appear that women married to lower social class men lived much more local lives. The largest change in distance migrated shown in Table 1 is evident amongst miners' wives whose mean life-time migration almost doubled between 1851 and 1881. This is primarily due to the growth of the mining industry, which was necessarily concentrated on the coalfields, necessitating an influx of new workers to such areas. By 1911, the mean life-time migration of women married to agricultural labourers increased to 29 km from a modest 15 km in the mid-nineteenth century.

[6] Individuals matched to more than one parish (because, for example, there were multiple parishes with the same name) were weighted between those parishes using the relative populations of each parish in the year of their birth. Overall, approximately 95% of the population in the I-CeM database was matched to as precise a place of birth as possible with each individual having an estimate of a minimum (matched only to the nearest possible parish), average (population-weighted average of all possible parishes) and maximum (matched to the furthest of the possible parishes) distance migrated. We report average distance in all the calculations, but results using minimum are very similar.

(Table 1 about here)

Registration Sub-Districts (RSDs)

The main geographical units of analysis are the Registration Sub-Districts (RSD). There were approximately 2,000 of these administrative units at each census year, and they formed the basis of the civil registration system overseen by the Registrar General, as well as being one of the reporting geographies for each decennial census between 1851 and 1911. They varied considerably in size, ranging in area from fewer than 30 to well over 100,000 acres, and in population size from a few hundred people to 150,000 persons or more. RSDs which were predominantly urban tended to be smaller but more populous. However not all RSDs covered a uniformly urban or uniformly rural area: some contained both part of a town and some of the surrounding area, while others which were mainly countryside included settlements of varying sizes. That makes it difficult to classify them as purely urban or rural environments. Over this period, there was a considerable amount of re-drawing of the RSD boundaries, especially between 1891 and 1901 census when many, mostly urban, RSDs were merged to form larger units. The constantly changing nature of RSDs means that we observe a different number of units at each census. Previous research on fertility decline in England and Wales has mostly used larger administrative units: Counties (≈ 50 units) or Registration Districts (RD ≈ 600 units) as the main units of analysis (Glass 1938; Teitelbaum 1984; Woods 1987, 2000). RSDs provide a considerably more local context, and therefore in this analysis we use RSDs as a proxy for the local community in order to examine the impact of individual- and family-level characteristics on fertility behaviour in the context of locality.

Analysis

Our analytical strategy takes two approaches. First, we measure the relationship between marital net fertility and individual-level characteristics and investigate how it changed during the first few decades of the fertility transition. We estimate the same set of models for all available census years – 1851, 1861, 1881, 1891, 1901 and 1911. The analysis follows a fixed-effects modelling strategy where marital net fertility is the dependent variable and the two main variables of interest are social class (*SC*) and distance from place of birth or life-time migration (*LTM*). We also include a number of individual-level control variables (X_t) in the model – age of woman, age difference between spouses, and husband's household position (whether or not he was head of the household):

$$y_{ij} = \alpha + \beta_1 SC_{ij} + \beta_2 LTM_{ij} + \beta_t X_{tij} + \gamma_j + \varepsilon_{ij} \qquad (1)$$

where i refers to a woman and j to her RSD of residence and γ_j is the RSD unit fixed effect.[7] We include the RSD-level fixed effects to control for structural differences and unobserved heterogeneity across geographical units, meaning the identification of the models is based entirely on variations in marital net fertility within RSDs.[8] The two age variables (age of woman and age difference between spouses) control for age dependencies in fertility. Husband's household position is proxy for household resources, on the basis that a woman whose husband was not head of household would have been more likely to be younger, very recently married, or suffering from financial hardship and limited access to resources such as housing or childcare. In addition to the models that include all married women with spouse present, we estimate a separate set of models for each social class to investigate the extent to

[7] As the independent variable is based on count data, we also ran a number of sensitivity tests with Poisson-specification. Our model outcomes were the same in both modelling strategies. For results see Table A3 in the Online Appendix.

[8] In order to test if our model results can be interpreted as changes in fertility behaviour and not the direct outcome of underlying RSD geography changing, we ran a sensitivity analysis using consistent geography across all census years. This was based on the amalgamated 588 Registration Districts applied first by Hinde and Harris (2019) to study mortality decline in the same period. The results are presented in Fig. A1 (included in the Online Appendix). It is reassuring that using constant geography confirmed all our main findings and the estimates for social class differences in net fertility are similar to the results from the main fixed-effects models (using changing number of RSDs across years).

which differences in fertility by distance from place of birth can be explained by class-specific migration trajectories.[9]

(Table 2 about here)

Table 2 presents descriptive statistics for all the variables included in the analysis. The two main variables of interest are husband's social class and distance from wife's place of birth. More than 60% of all the women observed at each census were married to men in social classes II to V, but the table also reveals considerable variation between the social classes across census years. As might be expected in an urbanising and industrialising country, there was considerable decline in the absolute, and relative, numbers of women married to agricultural labourers between 1851 and 1911. Textile workers were the only class that did not change much over the period in absolute numbers, but they did experience a small decline in relative terms. Women married to upper and middle class men and to miners experienced the greatest growth. As expected from the long-standing tradition of neo-local marriage, the vast majority of husbands were head of their own household, and the percentage who were not decreased a little over time.

There was a change over time in the distance women migrated between birth and enumeration in the census. The proportion of women residing less than 10 km from place of birth declined from 53% in 1851 to 49% in 1911. The main increase was in the category of long-distance migration (more than 50 km), which rose from 16% of women to 24%. This means that the absolute number of married women who had migrated further than 50 km from their place of birth to their place of residence was more than three times higher in 1911 than in 1851.

Increases in age at marriage and reductions in adult male mortality mean that in the later censuses our population of currently married women included a larger proportion of older

[9] All the data transformations and fixed-effects modelling was carried out in R version 3.4.2 (R Core Team 2017) using the 'pglm' or 'plm' packages (Croissant 2017; Croissant and Millo 2008).

women: the percentage of 20–24 olds declined from around 10.5 in 1881 to only 6.7 in 1911. The age difference between spouses seems to have decreased over time; the proportion of women married to a man of similar age (husband 0–2 years older) increased from 32% in 1851 to 38% in 1911. This was at the expense of large age-gaps between spouses (more than 6 years), which declined, most probably due to declining mortality which will have meant that there were fewer couples composed of a widower and his younger second wife.

Results

One of the indirect demographic measures most frequently employed when describing net fertility differences using census data is the child-woman ratio (CWR) (Shryock and Siegel, 1980). We use the CWR, here defined as the number of surviving children aged 0–4 per 1,000 married women aged 15–54, based on our sample of married-spouse-present women and their children, to explore the spatial patterns at the RSD-level. Fig. 2 shows the changing levels of net fertility in England and Wales for all the available census years. It is clear that during the first stages of fertility decline the overall distribution of CWRs shifted; by 1911 the CWRs were less than 0.8 in most RSDs, whereas before 1881 they were mainly higher than 0.8 or 0.9. As expected, an early decline is visible in the textile districts of Lancashire and West-Yorkshire in the vicinity of Manchester. Mining centres stand out with high net fertility throughout the period, the main coal-fields being located in South Wales, Durham, and along a spine running through Yorkshire, Derbyshire and Nottinghamshire. The spatial fertility pattern is clearly underlined by the very distinct occupational geography of England and Wales, where certain industries expanded in particular regions. These regional patterns of occupational structure shaped local employment opportunities for men and women. In textile areas, for instance, female labour force participation rates were high and there were opportunities to remain at work after marriage or return to work after having had a child, and nuptiality and marital fertility rates were lower than in most working class districts (Woods

1987). In addition to the textile areas, large urban centres, such as London, also demonstrate lower CWRs; however, these are not clearly visible on national scale maps such as those in Fig. 2.

(Fig. 2 about here)

Social class differences in fertility

Table 3 provides the CWR by social classes over time. Most social classes experienced declines in net fertility after 1881 and 1891 but the upper and middle classes and textile workers had undoubtedly the earliest and fastest declines. Meanwhile, the women married to miners and unskilled workers experienced relatively slow declines which started somewhat later in the period. These CWR patterns demonstrate considerable widening of relative class differences in the number of young children born and still resident in the home during the early phases of fertility transition. For example, in the first three censuses the difference between the low CWR of the upper and middle classes and the high CWR of the miners was around 25%, however this figure increased to 43% in 1891, 70% in 1901, and 86% in 1911. This is largely driven by the particularly rapid decrease in net fertility of women married to upper and middle class men.

(Table 3 about here)

We also investigated the extent of possible spatial clustering of CWRs by social class by deriving Moran's *I* indices on the RSD-level class-specific measures (Table 3 above).[10] We estimated Moran's *I* only for social classes I–V as these groups were present in most districts. As expected, these measures show relatively strong positive spatial autocorrelation. The upper and middle class (social class I) again stands out with the lowest Moran's *I* values in

[10] The spatial weight matrices define neighbours by contiguity with first-order queen definition of adjacency. RSDs are neighbours when they share at least one common part of their border and each neighbour is given equal weight within a matrix.

each census year. This suggests that fertility levels, and possibly also patterns of fertility decline, among the higher social classes were largely unaffected by geography. Spatial fertility patterns amongst the other classes were, however, more strongly related to geography. These spatial differences also clearly emerge on maps of CWR by social class (included in the Online Appendix; Fig. A2–A6). The decline of CWR for social classes II–V is much more concentrated in to textile areas, most likely shaped by local employment opportunities for women before marriage in those districts.

Fig. 3 presents the results of the fixed-effects models, which demonstrate that the differences in net fertility between the social classes were minimal during the first two decades of our observation period. With the onset of fertility decline, however, large differentials emerged in net fertility and these remained substantial even when individual-level demographic control variables were included in the model and when the identification only reflected marital net fertility differences within RSDs.[11] Women married to upper and middle class men, who are taken as the reference category, experienced the lowest net fertility from the 1881 census onwards. The wives of miners and agricultural labourers had the highest net fertility and the slowest declines over the same period; the CWRs (see Table 3) also show that miners started to experience declining fertility considerably later than other social groups - not until the early twentieth century. Haines (1979) argues that the distinct demographic behaviour of miners was mainly influenced by the employment opportunities available in their local areas, including earnings for men which peaked at young ages, an earning potential for young children (especially in mid-nineteenth century), an absence of female employment, and a male-centred culture. The fact that mines were generally situated in largely rural areas also had implications for the mining communities: it made them socially and geographically

[11] Sensitivity checks with OLS models without fixed-effects specification (see Fig. A7 in the Online Appendix) demonstrate that a considerable part of differences in net fertility amongst the lower social classes is explained by unobserved spatial heterogeneity measured at RSD-level. However, the model estimates for the higher social classes are relatively similar, whether fixed-effects models were used or not. These patterns prevail at every census year.

isolated. Similar patterns have also been observed amongst miners in other countries on mainland Europe (Haines 1979; Wrigley 1961).

Unskilled labourers also exhibited late onset of family limitation but they started from lower levels of fertility in the pre-transition period. Their slow fertility decline means that by 1911 women married to unskilled labourers had joined miners' and agricultural labourers' wives in having the highest fertility. One explanation for this may be that the unskilled labourers were experiencing high infant and early childhood mortality rates before the 1880s but in the next few decades their child survival improved more quickly than fertility declined. It is clear that over time the net fertility of the upper and middle classes became increasingly distinct from those of 'the lower orders'. Women married to textile workers also diverged from the other manual classes but their fertility decline was not as fast as that experienced by the upper and middle classes over the period studied. Overall, socio-economic differentials in net fertility widened during the first stages of the fertility transition (Skirbekk 2008). The results highlight that the fertility decline within the working classes was more occupationally-specific than class-specific[12], making it important to separate textile workers from other manual labourers when analysing changing fertility behaviour in England and Wales.

(Fig. 3 about here)

One of the main limitations of using only the number of surviving children enumerated with mothers at the time of census to study social class differences in fertility is the potential influence of differential mortality experiences, in particular the lack of a uniformly positive correlation between fertility and early age mortality. We wanted to ensure that the social class patterns revealed by our analysis of net fertility were not driven by differences in early age mortality, and the additional questions about fertility in 1911 census allow us to run a number of sensitivity tests to examine whether the observed social gradient in fertility holds even

[12] The RG's classification of 'social classes' is rather misleading because in the end the abnormal groups that did not fit the class gradient were separated to the three 'industrial classes'.

when we account for mortality. The enumerators of the 1911 census collected data from all married women on children ever born during their current marriage, children surviving and marital duration. Unfortunately, the census does not provide information about when children were born nor, if any died, at what age they had done so (Fertility of Marriage 1923). However, using these data, we can estimate two additional models to compare the social gradient in fertility obtained with different measures of fertility. We used a more limited population of women who, in 1911, had been married for less than five years and for whom net achieved fertility over the duration of their marriage reflected recent net fertility. As before, we limited our analysis to women with husbands present on census night.

The first model (M1) uses net achieved fertility as the dependent variable – using only the number of children alive at the time of the 1911 census born to those women who had been married for less than five years. In the second model (M2), we use another measure of fertility for the same population of women – the total number of children ever born, which also includes the children a woman might have lost prior to the census enumeration. Fig. 4 also shows the results of the main model (labelled 'children under 5'). The difference between the main model and M1 are due to the fact that the latter uses only recently married women whereas the main model uses women of all marital durations. We would expect recently married women to have higher fertility for two main reasons: firstly because they are younger and more fecund - this aspect is controlled for by the inclusion of age in the models. The second reason is the interval from marriage to first birth tends to be smaller than the intervals between births because there is no post-partum or lactational infecundability, and this is the reason for the differences between the main model and M1 estimates in Fig. 4. Engagement in pre-marital intercourse also reduces the interval between marriage and first birth, and the larger gaps between the main model and M1 for agricultural labourers and unskilled workers may indicate a higher prevalence of pre-marital pregnancy among these classes.

(Fig. 4 about here)

Differences between M1 and M2 in Fig. 4 result purely from differential effects of mortality: because the upper class had the lowest risk of child mortality overall in 1911, using net fertility instead of total fertility dampens the social class differences in fertility, and this effect is strongest for groups with higher mortality, such as miners (Reid 1997). However it is also clear that the overall social gradient and relative differences in fertility are very similar when using these different measures of fertility, although they were muted when net fertility is used. This supports our supposition that the social class differences we identify in marital net fertility also hold for marital fertility and are not distorted by differential mortality in different social groups.

The role of migration on fertility decline

The net life-time migration variable in Fig. 5 demonstrates interesting patterns. In all census years, the reference category, women residing within 10 km of their place of birth, had the highest net fertility. There is a clear gradient in the relationship between recent marital net fertility and the distance from place of birth: longer distances migrated were associated with lower net fertility. During the period between 1851 and 1901 the gradient and differentials were fairly stable but diminished somewhat by 1911. Overall, our results do not indicate a distinct change in the role of migration during the first decades of fertility transition, after 1881; instead we find that the differences remain largely intact throughout the period.[13]

(Fig. 5 about here)

We also tested whether a couple's fertility behaviour might have been independently influenced by the husband's life-time migration. The results of these models are presented in Fig. 6. For those born in England and Wales, inclusion of the husband's migration makes little

[13] Additional sensitivity checks, implementing models without fixed-effects specification (see Fig. A8 in the Online Appendix) show the importance of spatial heterogeneity in net fertility estimates by distance from place of birth. However, over time less of the variation in net fertility is explained by the structural differences across RSDs.

difference to the effects of the wife's migration, indicating that the latter has a largely independent effect on fertility. The effects of husbands' life-time migration on fertility shows a similar pattern to that of their wives but the differences in net fertility are much smaller for husbands' migration, confirming our expectation that women's own migration trajectories were much more influential than those of their husbands in determining net marital fertility. For those born overseas, however, the effects are somewhat different: here the effect of husbands' migration seems to confound that of wives', as the effects for wives increase once husbands' migration is controlled. We suspect that different countries of origin and migration patterns over time make this a product of a variety of different experiences, and these will be explored in subsequent research.

(Fig. 6 about here)

In order to explore whether the differences in net fertility were more responsive to the length of life-time migration for some social classes than others, we estimated a separate set of models for each social class in every census year. The national pattern in the fertility-migration relationship is largely guided by differences in the first five social classes; they demonstrate the same gradient across all census years. The exceptions are the three 'industrial classes' (miners, agricultural labourers and textile workers), who also exhibited the shortest mean net life-time migration distances across all census years (see Table 1). The new sets of model estimates for the women married to textile workers, miners, unskilled workers and the upper and middle classes are shown in Fig. 7 (model estimates for all class-distance combinations are shown in Fig. A9). A longer distance migrated from place of birth to place of residence at the time of enumeration was associated with lower fertility for the unskilled workers, with a clear gradient from less than 10 km, through 10–50 km to more than 50 km. This pattern also holds for social classes II to IV (Fig. A9). The differences amongst the upper and middle class women were somewhat smaller. The most locally born miners' wives also show higher fertility than those who had migrated further within England and Wales, although the effects are small and there is no clear gradient with increasing distance. In contrast, women married to textile workers were the only social class for whom being born locally was associated with lower fertility: from 1891 textile workers born more than 50 km away had significantly higher fertility.

(Fig. 7 about here)

Discussion

In this paper we set out to use individual-level historical census data for England and Wales to explore the interplay between social class, migration, geography and fertility in order to gain a greater understanding of differences in net fertility during the second half of the nineteenth and the early twentieth centuries. Of course, the main limitations of using census data to study individual level fertility are firstly, that the analysis is based on cross-sectional data at ten year intervals, and secondly, the lack of mortality information. Nevertheless, in our sensitivity tests and also in previous work on estimating social class differences in fertility using the Own-Children Method where mortality rates are adjusted for, we obtained very similar patterns of fertility (Reid et al. 2019).

Our analyses confirm a clear pattern of widening social class differences in recent net fertility during the first decades of the fertility transition. These findings provide strong support for the argument that belonging to a certain social group was an important determinant of fertility behaviour and the timing of the onset of family limitation in marriage in England and Wales. We find that class differences in recent net fertility were very narrow prior to the transition. However, women married to upper and middle classes men and to textile workers initiated the move towards lower fertility, and showed considerably lower net fertility than other social classes during the early phases of transition. On the other hand, the wives of miners and agricultural labourers had the highest net fertility and did not exhibit any signs of fertility limitation until the early twentieth century.

It is encouraging that the results of this study are consistent with a plethora of previous work on class differentials during fertility decline in England and Wales (Anderson 1999; Garrett et al. 2001; Haines 1992; Szreter 1996; Woods 1984). Furthermore, extended work on the Swedish fertility transition has also highlighted the role of the upper and middle classes in leading the way in reducing family size in the late nineteenth century (Dribe and Scalone 2014; Klüsener et al. 2019). Similarly, international comparisons have found exactly the same patterns of widening socio-economic differences in fertility for other countries in North America and Europe (Dribe et al. 2014; Haines 1992). In general, these studies and our current results provide support for universal patterns of widening social class differences in fertility across different populations and similarities in how these evolved over the early phases of fertility decline.

The present study has been one of the first attempts to explore the relationship between individual migration patterns and fertility during the fertility transition in England and Wales. In contrast to the findings by Klüsener *et al* (2019) for Sweden, our results reveal that longer distance net life-time migration, measured using distance migrated from place of birth to place of residence, was associated with lower marital net fertility in England and Wales. We also find that this effect was relatively constant throughout the whole period, without a distinct change in the pattern at the onset of fertility decline. Therefore, it is difficult to suggest that long-distance migrants were the early adopters of family limitation with better access to information and new social attitudes towards fertility behaviour. It is more likely that life-course migration patterns determined observed fertility differences through the postponement of marriage and starting a family. However, it is important to consider that while major demographic changes were occurring in society, the meaning of distance was also transforming. Not only did the rapidly developing transport and communication networks transform the significance of short and long distance migration, allowing people to travel longer distances in shorter times, but the increasing numbers of women and their husbands who had undertaken moves from place of birth to new place of residence meant that information flows and knowledge fields must have been much more evenly distributed across the population by the end of our period than they were at the beginning.[14] As a result new behaviour could be transmitted increasingly swiftly across space and all levels of society.

In contrast to every other social class, however, textile workers' wives who were born locally (less than 10 km from place of residence) exhibited increasingly lower fertility than those born further away, and this pattern emerged at the onset of fertility decline. Using 1881 census data Day (2015) has suggested that in the latter part of the nineteenth century migration into some textile towns was far less important than it had been in earlier periods of growth. It seems that those few who did migrate from elsewhere were much less likely to have lower fertility than the women who married textile workers more locally. Possible explanations for this might be that women from further away did not grow up with the textile mills as earning potential before marriage or it might have been more difficult for non-natives to get work in the mills due to discrimination, lack of contacts or skills. Overall, this suggests that the economic and social contextual factors of textile areas were important in shaping local fertility behaviour over and above the life-course migration patterns that might influence longer-distance migrants to postpone marriage and child-bearing.

The early adoption of new reproductive behaviour by upper and middle class couples and also by women married to textile workers is a strong indication that fertility transition in England and Wales was not dependent on just the process of innovation, initially accessible only to certain members of the upper classes of the society. Banks' (1981) argument of *direct diffusion,* the working classes copying the family limitation practices used by higher social

[14] This can also be seen through marriage patterns. For example, Perry (1969) suggests that the level of exogamous marriages and the distance recorded between marriage partners increased significantly from the 1880s for working class marriage partners in rural Dorset. A similar transition can be seen in the urbanising seaside resort of Southend-on-Sea (Schürer 1982).

classes, seems hardly convincing in this context. This is particularly the case when the motivations driving child-bearing and child-rearing practices, which were shaped by local and class-specific experiences, were also dramatically changing over the second half of the nineteenth century (Pooley 2013). The distinct early fertility declines amongst upper and middle class women and the wives of textile workers compared to the wives of other manual workers is in line with the idea of *multiple fertility transitions* introduced by Szreter (1996). Rather than a simple socially graded single process, fertility decline in England and Wales occurred in different ways across different communities, and where spatial patterns of fertility transition were magnified by distinct residential patterns or occupational concentration of certain social classes in different parts of the country.

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Table 1 Age-standardized mean life-time migration (in kilometres) for married women aged 15–54 by social class of husband in England and Wales, 1851–1911.

	1851	**1861**	**1881**	**1891**	**1901**	**1911**
Husband's social class						
Upper and middle class	66.35	69.66	70.77	69.01	66.09	63.44
Social class II	33.50	38.82	42.25	45.64	45.55	47.01
Social class III	36.44	40.68	43.02	43.62	42.51	42.08
Social class IV	37.25	41.45	43.40	44.67	43.64	43.90
Unskilled workers	33.34	38.05	39.06	39.09	36.34	34.63
Textile workers	19.04	21.14	21.42	23.87	24.48	24.42
Miners	20.62	25.82	38.43	37.57	34.42	35.77
Agricultural labourers	14.83	19.10	17.62	19.40	22.67	28.80

Source: Calculated using Schürer and Higgs 2014; Day 2018b

Table 2 Distribution of variables (%)

	1851	*1861*	*1881*	*1891*	*1901*	*1911*
Number of children						
0	46.41	47.28	46.58	48.95	51.98	55.54
1	27.54	27.04	25.63	26.38	27.34	26.93
2	21.45	20.90	21.64	19.38	16.60	14.23
3	4.35	4.50	5.74	4.94	3.83	3.07
4	0.24	0.28	0.40	0.34	0.25	0.23
5+	0.01	0.01	0.01	0.01	0.01	0.01
Age group of wife						
15-19	0.66	0.83	0.85	0.60	0.43	0.28
20-24	9.53	10.21	10.54	9.52	8.66	6.67
25-29	17.16	16.91	17.87	17.53	17.6	15.96
30-34	18.50	17.97	17.92	18.28	18.89	19.25
35-39	16.95	16.72	16.47	17.02	17.44	18.48
40-44	15.05	15.26	14.74	14.77	14.94	15.90
45-49	12.17	12.37	11.92	12.35	12.32	13.18
50-54	9.98	9.73	9.68	9.93	9.72	10.28
Age difference between spouses						
Wife older	24.78	23.85	22.97	22.47	21.98	22.45
Husband 0-2 years older	32.15	32.21	35.19	36.26	38.01	38.17
Husband 3-5 years older	20.27	20.20	20.73	20.82	21.09	21.11
Husband >6 years older	22.80	23.74	21.12	20.44	18.92	18.27
Husband's household position						
Head of household	97.71	98.36	96.32	98.30	98.23	98.17
Other	2.29	1.64	3.68	1.70	1.77	1.83
Husband's social class						
Upper and middle class	4.74	4.88	7.31	7.90	8.96	10.16
Social class II	17.09	16.17	16.03	16.11	15.96	16.04
Social class III	22.36	22.29	24.18	24.27	24.99	23.63
Social class IV	12.22	12.69	15.36	15.76	16.72	17.16
Unskilled workers	13.12	14.13	16.53	17.05	16.45	15.67
Textile workers	7.02	6.09	4.41	4.07	3.61	3.34
Miners	4.18	4.88	5.69	6.31	6.85	8.05
Agricultural labourers	16.23	13.54	7.63	5.91	4.12	3.76
Unknown	3.03	5.33	2.87	2.61	2.34	2.18
Distance from place of birth						
Less than 10 km	53.46	49.15	48.69	48.63	49.41	48.62
10-50km	24.73	24.16	22.85	22.91	22.75	22.95
More than 50 km	16.33	19.18	22.00	23.15	23.17	23.54
Abroad	5.35	7.32	6.18	5.16	4.57	4.85
Unknown	0.13	0.19	0.28	0.14	0.10	0.05
Number of women	2,223,976	2,541,617	3,235,007	3,507,452	4,111,065	4,659,742
Number of RSDs	2,176	2,189	2,175	2,110	2,060	2,009
Total population	17,565,129	19,320,569	25,954,690	28,902,862	32,315,517	36,031,749

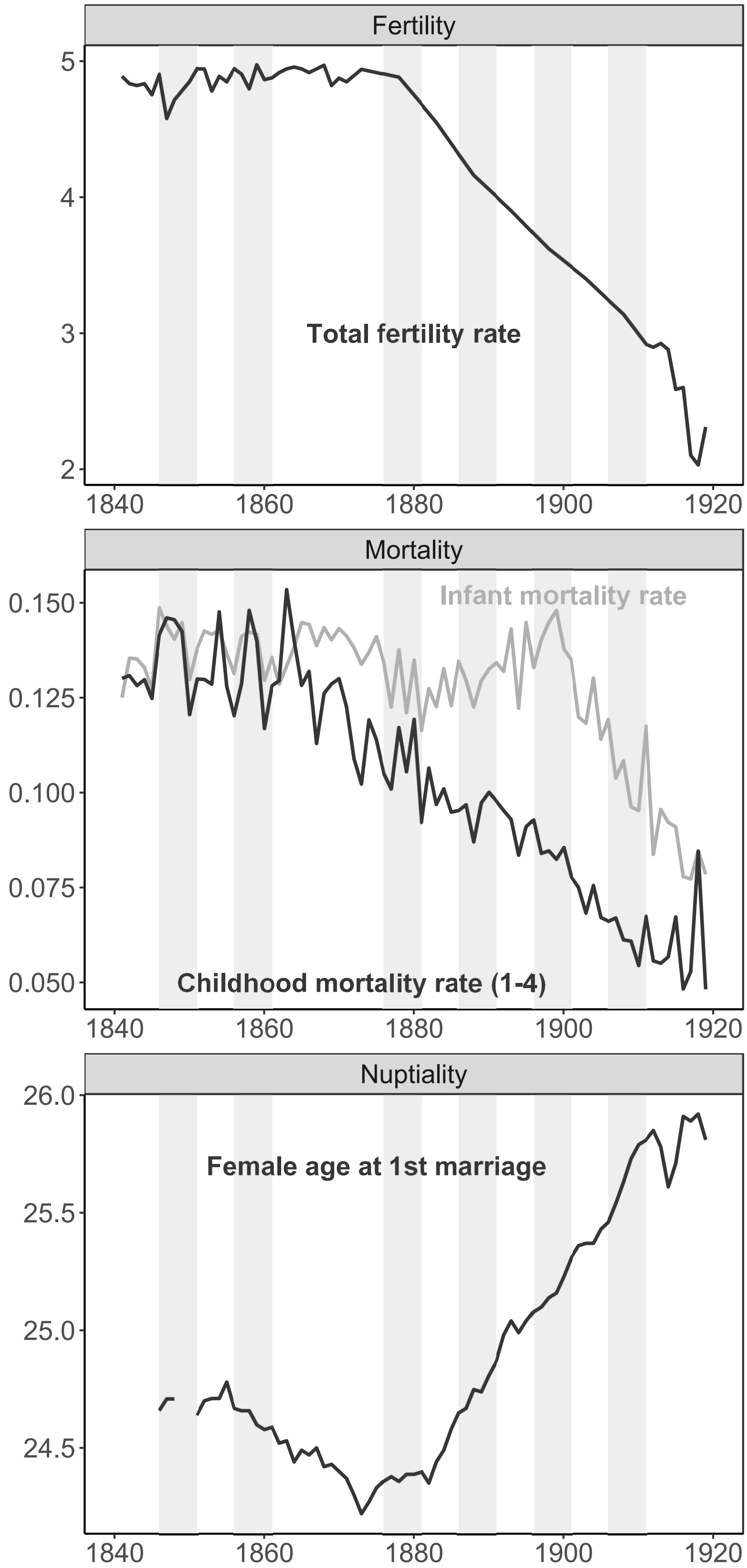
Source: Calculated using Schürer and Higgs 2014; Day 2018b

Table 3 Child-woman ratios (children aged 0–4 per married spouse present women aged 15–54) by social class of husband and spatial autocorrelation measures, England and Wales, 1851–1911

	1851	1861	1881	1891	1901	1911
			Child-woman ratios (CWR)			
Husband's social class						
Upper and middle class	0.801	0.812	0.832	0.697	0.564	0.491
Social class II	0.784	0.784	0.809	0.727	0.637	0.561
Social class III	0.857	0.847	0.923	0.841	0.747	0.657
Social class IV	0.865	0.862	0.915	0.838	0.751	0.660
Unskilled workers	0.830	0.840	0.881	0.862	0.818	0.772
Textile workers	0.826	0.806	0.829	0.760	0.636	0.536
Miners	1.032	1.003	1.036	0.997	0.961	0.915
Agricultural labourers	0.931	0.901	0.925	0.890	0.828	0.748
Total	0.845	0.835	0.878	0.814	0.731	0.655
			Moran's I of CWRs			
Husband's social class						
Upper and middle class	0.04	0.02	0.09	0.03	0.11	0.13
Social class II	0.28	0.26	0.22	0.23	0.30	0.33
Social class III	0.27	0.23	0.23	0.18	0.21	0.29
Social class IV	0.16	0.14	0.16	0.15	0.23	0.31
Unskilled workers	0.13	0.12	0.18	0.22	0.15	0.21
Total	0.52	0.48	0.51	0.50	0.53	0.60

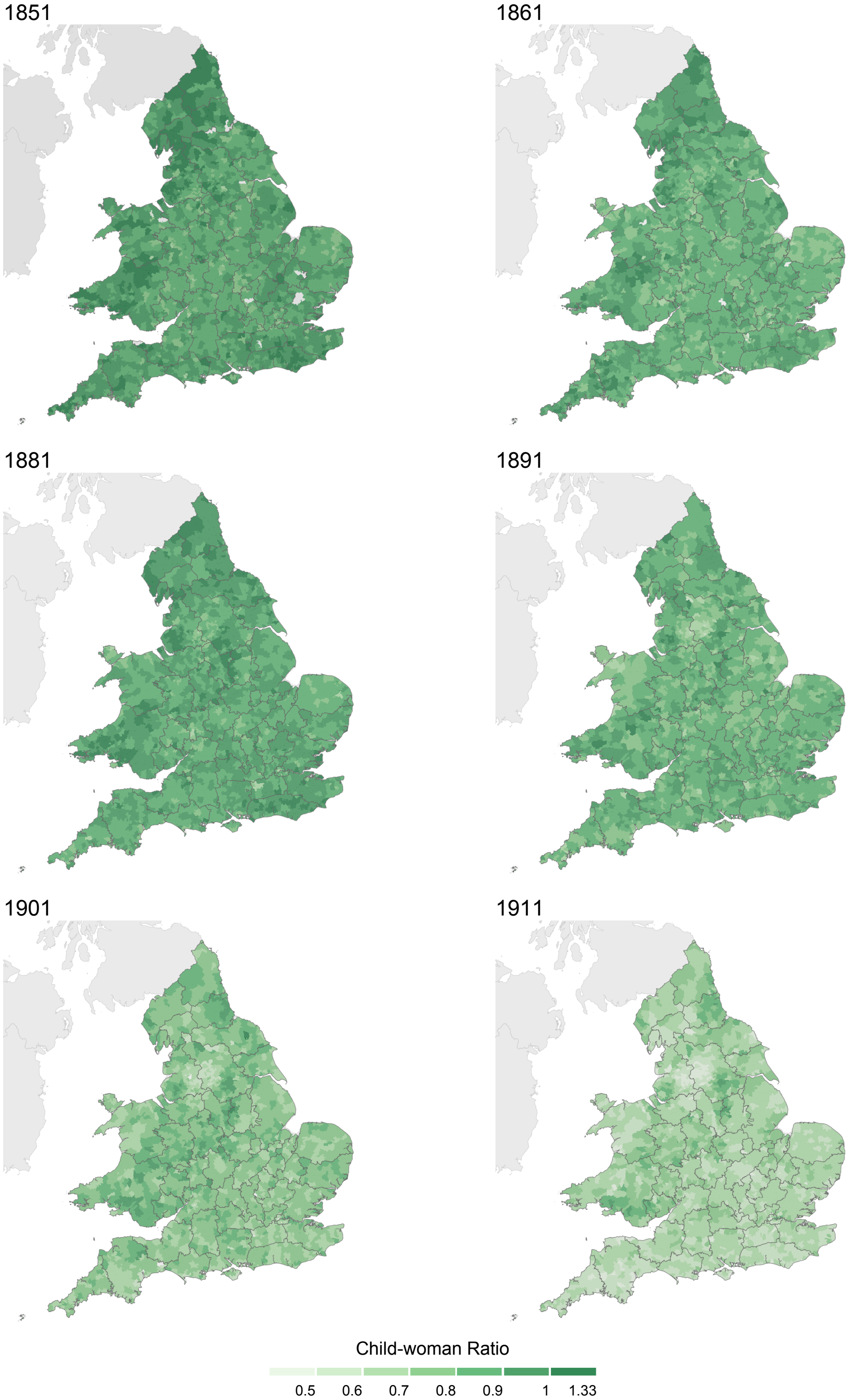
Source: Calculated using Schürer and Higgs 2014; Day 2018b

Fig. 1 Long term trends in fertility, infant and childhood mortality and nuptiality in England and Wales, 1840–1920



Note: Coloured bands show the 5 years before each census.
Source: Woods 2000; Human Mortality Database (2019); Wrigley et al. 1997, p.134; ONS 2011.

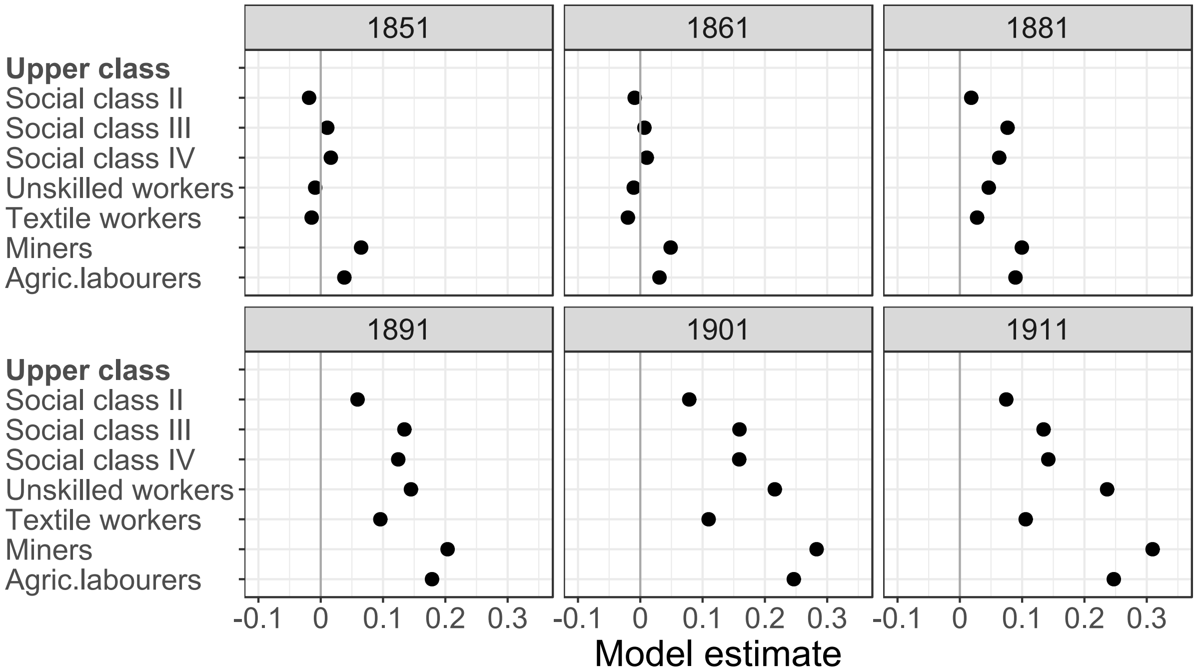
Fig. 2 Child-woman ratios (children aged 0–4 per married spouse present women aged 15–54) in Registration Sub-Districts, England and Wales, 1851–1911



Source: Calculated using Schürer and Higgs 2014
Base maps: Registration sub-district boundaries for England and Wales[15]

[15] The Registration Sub-District boundaries for England and Wales 1851–1911, used for Fig. 2 were created by Dr Joseph Day as part of the *Atlas of Victorian Fertility Decline*' project (PI: A.M. Reid) with funding from the ESRC (ES/L015463/1) using Satchell, A.E.M., Kitson, P.M.K., Newton, G.H., Shaw-Taylor, L., and Wrigley E.A. (2016). *1851 England and Wales census parishes, townships and places,* which in turn is an enhanced version of Burton, N., Southall, H. R. (2004). *GIS of the Ancient Parishes of England and Wales, 1500-1850.* [data collection]. UK Data Service. SN: 4828, http://doi.org/10.5255/UKDA-SN-4828-1, which itself is largely

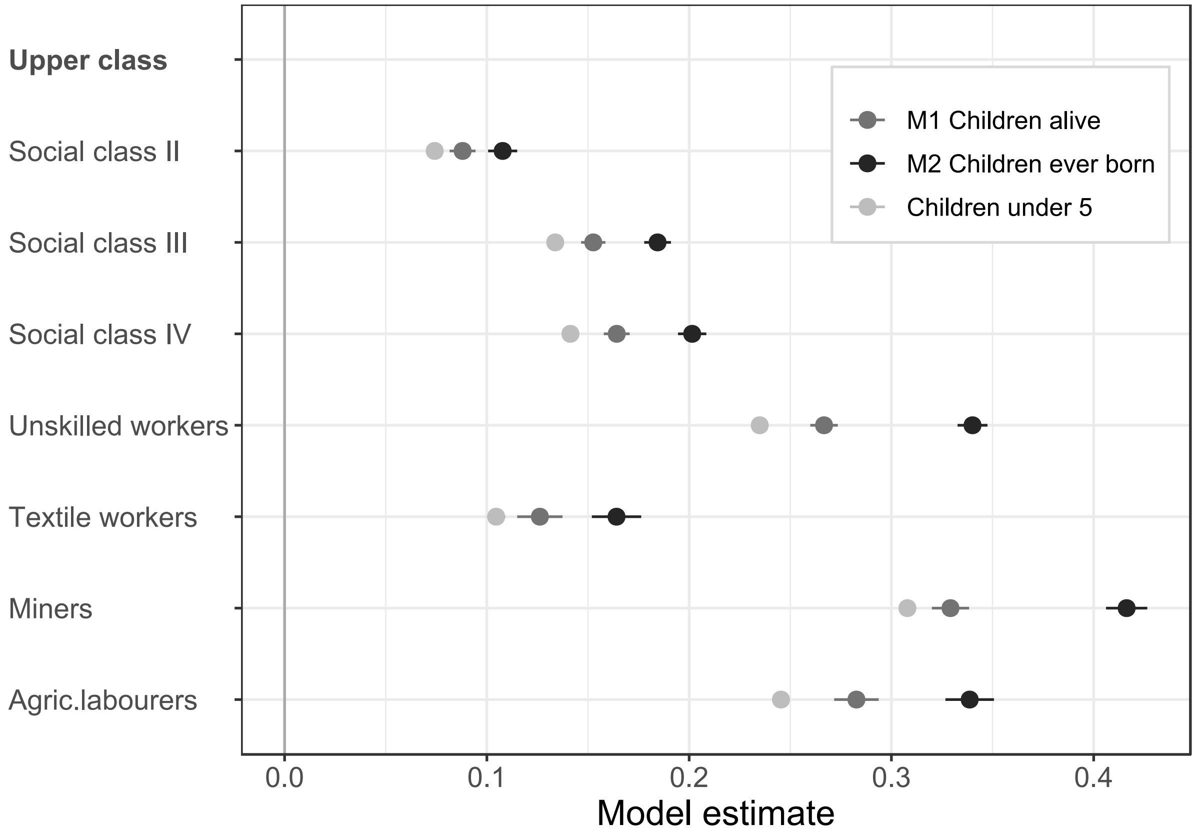
Fig. 3. Model estimates for the relationship between marital net fertility (number of children aged 0–4) and the husband's social class, England and Wales, 1851–1911.



Note: *Models control for age of woman, age difference between spouses, household status, and wife's distance from place of birth. Full model results in the Online Appendix (Table A2).*
Source: Calculated using Schürer and Higgs 2014; Day 2018b

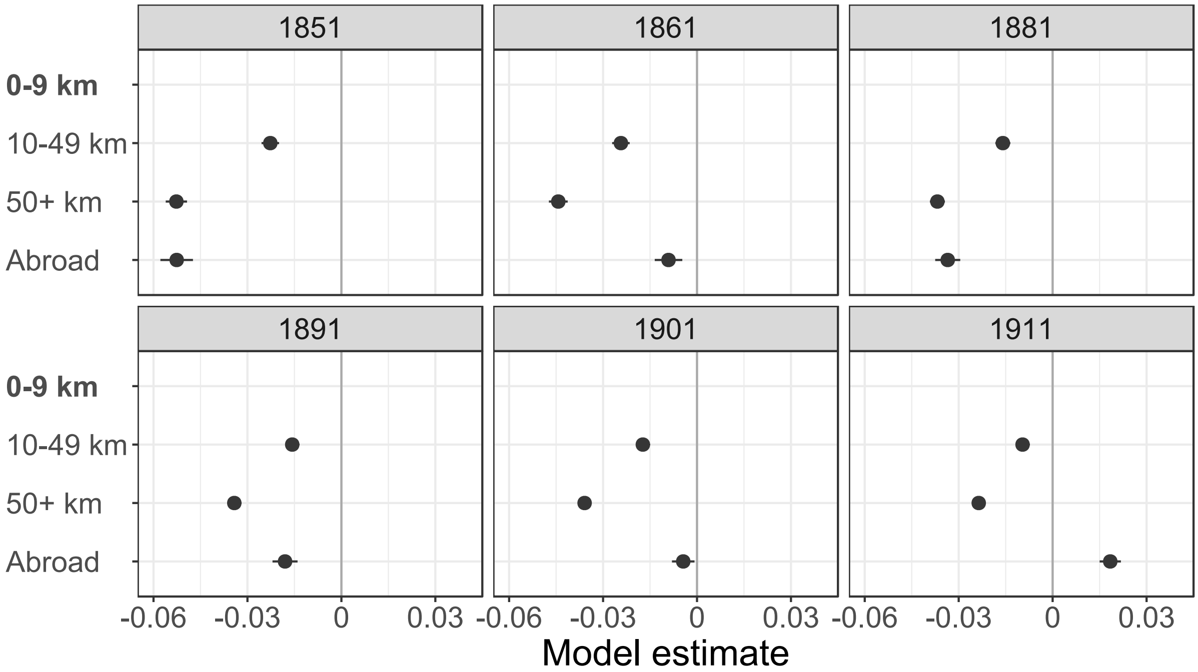
derived from Kain, R. J. P., Oliver, R. R. (2001). *Historic Parishes of England and Wales : an Electronic Map of Boundaries before 1850 with a Gazetteer and Metadata*. [data collection]. UK Data Service. SN: 4348, http://doi.org/10.5255/UKDA-SN-4348-1

Fig. 4 Model estimates for the relationship between the number of children ever born/children alive per couple and the social class of husband for women married less than 5 years aged 15–54 compared to the main model estimates (of children under 5) in England and Wales, 1911



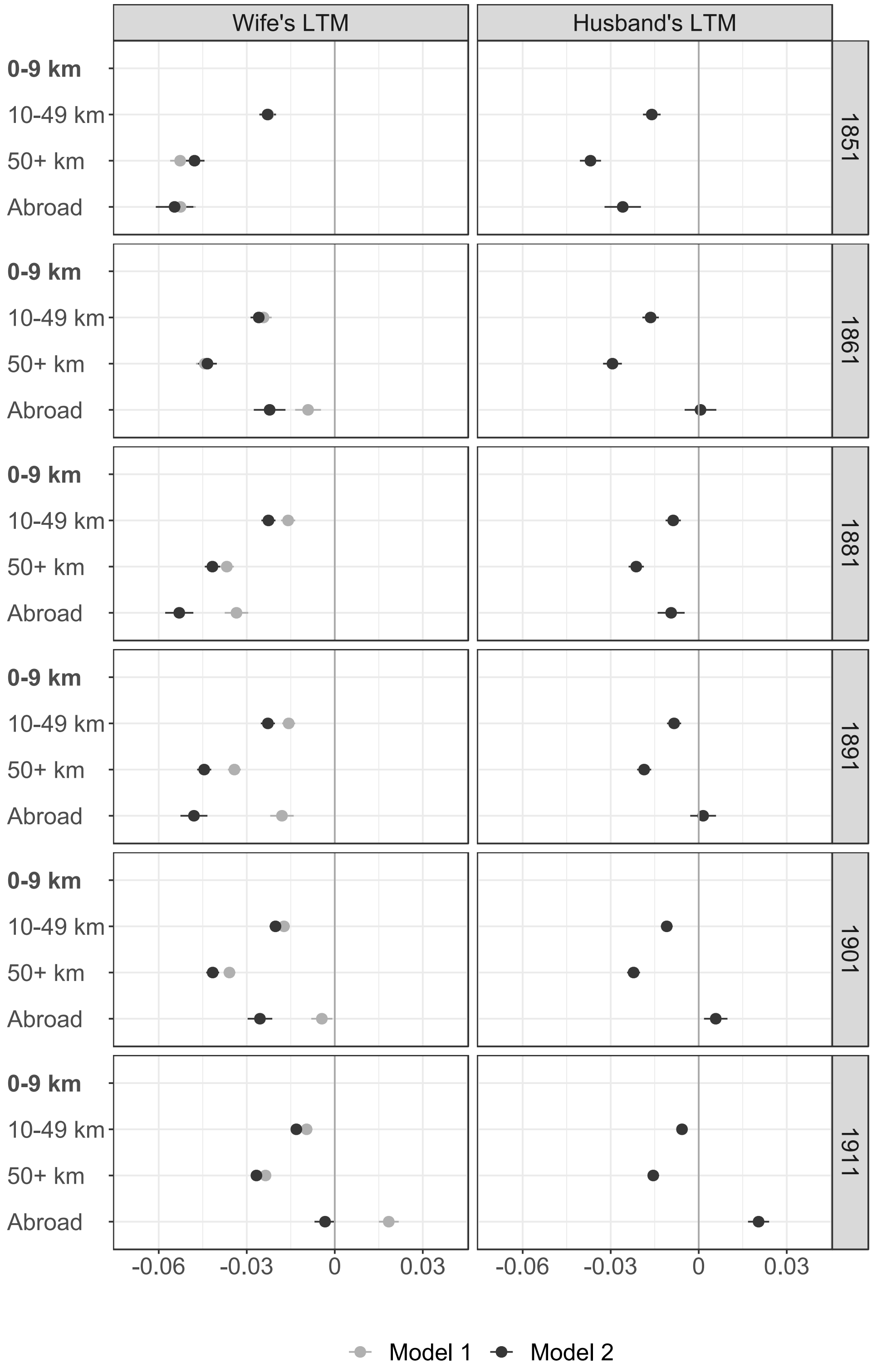
Note: *Models control for age of woman, age difference between spouses, household status, and life-time net migration.*
Source: Calculated using Schürer and Higgs 2014

Fig. 5 Model estimates for the relationship between marital net fertility (number of children aged 0–4) and wife's distance from place of birth, England and Wales, 1851–1911.



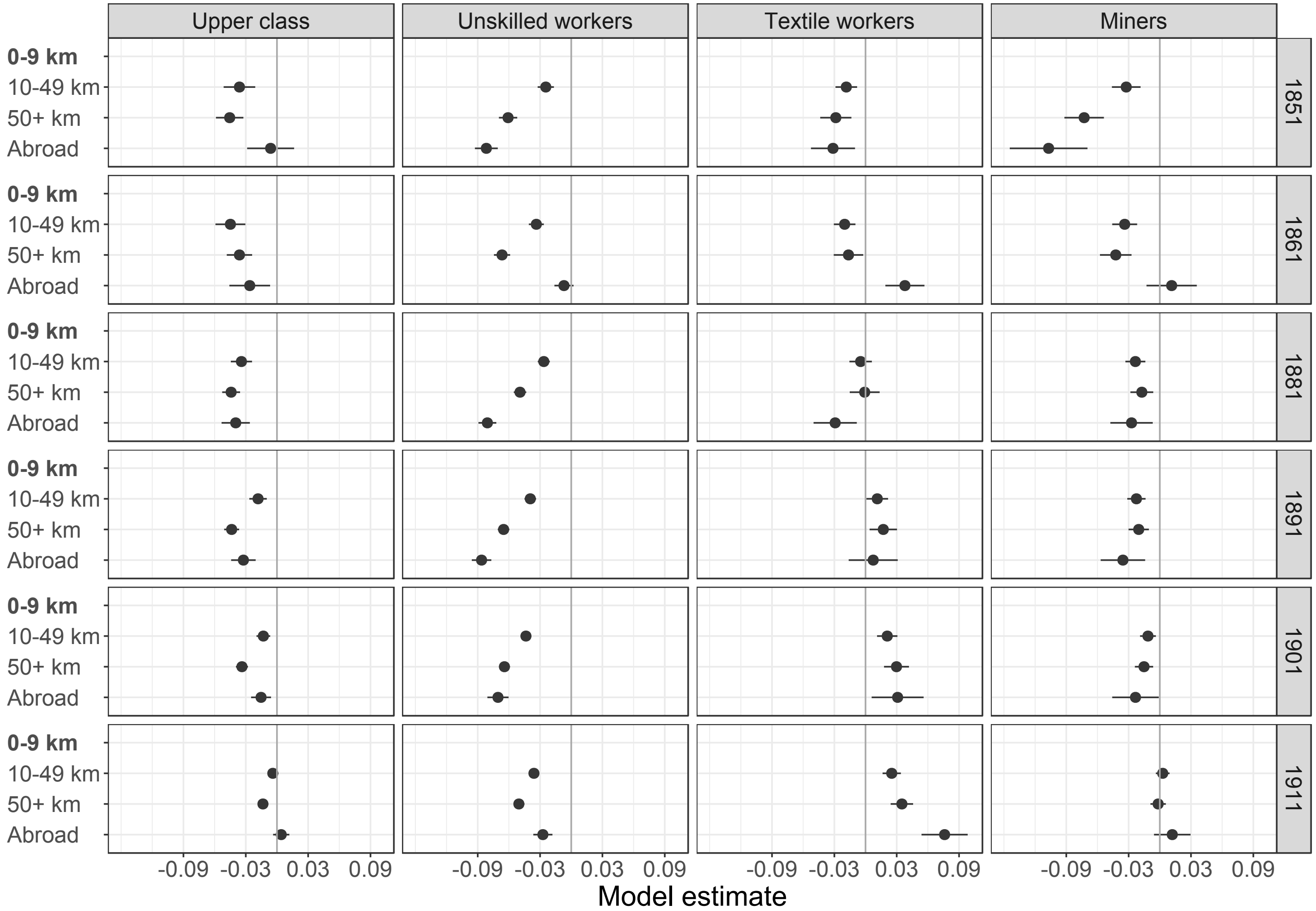
Note: Models control for age of woman, age difference between spouses, household status, and husband's social class. Full model results in the Online Appendix (Table A2).
Source: Calculate using Schürer and Higgs 2014; Day 2018b

Fig. 6 Model estimates for the relationship between marital net fertility (number of children aged 0–4) and both wife's and husband's distance from place of birth (Life Time Migration = LTM), in kilometres (km) England and Wales, 1851–1911.



Note: *Model 1 only includes wife's distance from place of birth. Model 2 includes both wife's and husband's distance from place of birth. Both models control for age of woman, age difference between spouses, household status, and husband's social class.*
Source: Calculated using Schürer and Higgs 2014; Day 2018b

Fig. 7 Model estimates for the relationship between marital net fertility (number of children aged 0–4) and wife's life-time migration distance, by husband’s social class, England and Wales, 1851–1911



Note: *Models control for age of woman, age difference between spouses, and husband’s status within the household.*
Source: Calculated using Schürer and Higgs 2014; Day 2018b